EGG SAC PARASITISM IN THE SPIDER *PHRYGANOPORUS CANDIDUS* (L. KOCH) (ARANEAE: DESIDAE) BY THE WASP *CERATOBAEUS SETOSUS* DODD (HYMENOPTERA: SCELIONIDAE)

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Abstract

The scelionid parasitoid *Ceratobaeus setosus* Dodd was found in nests of the social spider *Phryganoporus candidus* (L.Koch) (= *Badumna candida* (L. Koch)) at Townsville, northern Queensland. It occurred from April to October inclusive, the months of the host's egg production. The wasps selectively parasitized some egg sacs, probably on the basis of the age of the eggs within. The primary sex ratio of *C. setosus* was 88% female: 12% male. The mantispid egg predator *Austromantispa imbecilla* (Gerstaecker) was sometimes present in sacs that contained *C. setosus*.

Wasps of the genus *Ceratobaeus* Ashmead, like those of several other scelionid genera, exclusively parasitize spider eggs, often with marked host specificity (Austin 1984a,b). This oligophagous habit may be mediated by specific adaptations for penetrating host nests and egg sacs (Austin 1985). *Ceratobaeus setosus* Dodd has been recorded as a parasitoid of eggs of the amaurobioid spiders *Badumna longinqua* (L. Koch) and *B. insignis* (L. Koch) (previously *Ixeuticus robustus* (L. Koch) - see Gray 1983). Apart from these host records, nothing appears to be known of the biology of this species, but Austin (1984b) has provided much information about its congeners *C. masneri* Austin and *C. clubionus* Austin.

At Townsville, northern Queensland, between July 1987 and June 1989, I sampled monthly at random from dry sclerophyll woodland a total of 280 thriving and 23 moribund nests of the social spider *Phryganoporus candidus* (L. Koch) (= *Badumna candida* (L. Koch)), as part of a study of this spider's life history and nesting biology (Downes 1993, 1994a). A current revision, unpublished at the time of writing, proposes that *B. candida* revert to *P. candidus* (M. Gray, pers. comm.), so I adopt the latter name here.

C. setosus was present in 26% of the thriving nests of *P. candidus* and in 20% of the 1079 egg sacs they contained, either as free-living adults within the nest retreat or in various stages of development within the spider's egg sacs (Fig. 1) (Downes 1994b). No living *C. setosus*, adult or otherwise, were found in the nests between November and March inclusive, in either year, though sampling rates were similar to other months of the year. This marked seasonality of occurrence of the parasitoid (Fig. 2) reflected the host's oviposition cycle, which begins about March and continues until September (Downes 1993). Of the egg sacs that were parasitized, 82% were totally so, the remaining 18% containing one or more unaffected host eggs

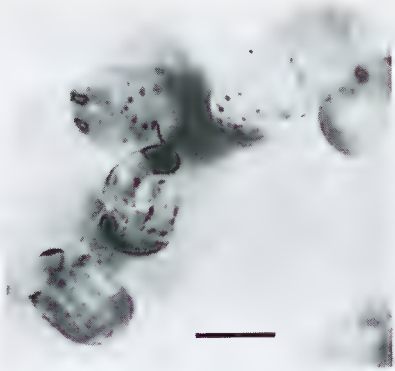

Fig. 1. An adult *Ceratobaeus setosus* emerging from the eggshell of its host, *Phryganoporus candidus*. Scale bar, 50mm.

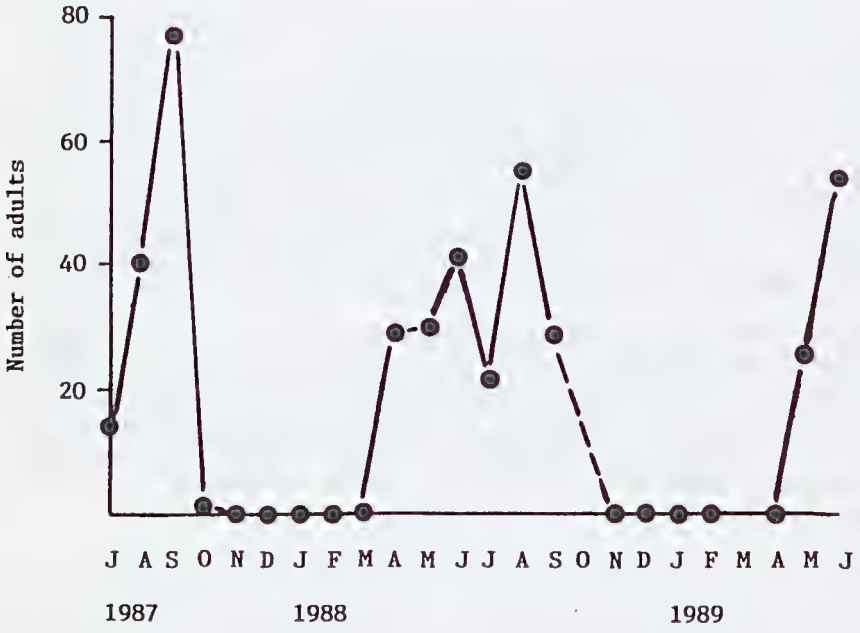

Fig. 2. Numbers of *Ceratobaeus setosus* adults free-living in nests of *Phryganoporus candidus*, emerging from host eggs as the sample was taken, or reared from host eggs. No sampling in October 1988 or March 1989.

that hatched normally into spiderlings. Since the spider's sacs were usually in clusters of 2-13, it was therefore common to find that contiguous sacs were either unparasitized or totally parasitized. This suggested that *C. setosus* normally oviposits only into relatively fresh eggs, as does its congener *C. masneri* which does not utilize host eggs older than two days (Austin 1984b).

Twelve fully-parasitized egg sacs that were extracted before any of the wasps were fully developed, and from which all wasps were successfully reared, gave primary sex ratios ranging from 76% female: 24% male to 95% female: 5% male, with a mean of 88% female: 12% male (totals were 269 females and 38 males). The resulting mean of 25.6 wasps per sac reflects the fecundity of the spider rather than that of the wasp. It was not determined whether the progeny from each egg sac was that of one female or more. If the former, this sex ratio bias suggests that local mate competition (Hamilton 1967) is probably occurring, since the sexes of *C. setosus* are equivalent in size, being distinguished primarily by the shape of the antennae. Male wasps probably leave the egg sacs before females and inseminate their subsequently-emerging sisters and/or females from other parasitized egg sacs in the same nest, as happens with *C. masneri* and *C. clubionus* which also have female-biased sex ratios (Austin 1984b). If so, both inbreeding and outbreeding take place.

On four occasions, egg sacs that produced *C. setosus* also contained the mantispid neuropteran *Austromantispa imbecilla* (Gerstaecker). In these cases, parasitoids and egg predators developed successfully together.

The host specificity of wasps of the genus *Ceratobaeus* (Austin 1984a,b) raises the question of how *C. setosus* survives in the Townsville area between October and February, when eggs of *P. candidus* are unavailable. In colder latitudes, wasps of this genus are quiescent as adults during the winter months when host eggs are unavailable, and they can survive for about 100 days at temperatures reflecting field conditions (Austin 1984b). In Townsville, however, the lack of host eggs coincides with the hottest time of the year, and it is unlikely that *C. setosus* adults are inactive during this period; they may utilize the eggs of *Badumna longinqua* (L. Koch), the only close relative of *Phryganoporus* (*Badumna*) *candidus* that occurs in the Townsville area and breeds in the summer (pers. obs.).

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